16.0 LOWER COLUMBIA RIVER CHINOOK ESU

16.1 BACKGROUND

16.1.1 Description of the ESU

The Lower Columbia River chinook salmon ESU includes all natural-origin populations residing below impassable natural barriers form the mouth of the Columbia River to the crest of the Cascade Range just east of Hood River in Oregon and the White Salmon River in Washington (65 FR 7764). The historical site of Celilo Falls, east of the Hood River in Oregon is considered the eastern boundary of this ESU since it may have been a migrational barrier to chinook at certain times of the year (Myers *et al.* 1998). The ESU does not include spring populations above Willamette Falls, or the introduced Carson spring chinook salmon stock. Tule fall chinook salmon in the Wind and Little White Salmon Rivers are included in this ESU, but not introduced upriver bright fall chinook salmon populations in the Wind and White Salmon Rivers and those below Bonneville Dam (Myers *et al.* 1998).

There are three different runs of chinook salmon in the LCR ESU: spring-run, late fall brights, and early fall tules. Spring-run chinook salmon in the lower Columbia River, have a stream-type juvenile life history and enter freshwater as adults in March and April, well in advance of spawning in August and September. Historically, fish migrations were synchronized with periods of high rainfall or snow melt to provide access to upper reaches of most tributaries where spring stocks would hold until spawning (Fulton 1968, Olsen *et al.* 1992, WDFW *et al.* 1993). The tule and bright fall chinook exhibit an ocean-type live history and northerly ocean migration patterns, with bright fish tending to travel father north than the tule stocks. Tule fall chinook begin entering the Columbia River in August, rapidly moving into the lower Columbia River tributaries to begin spawning in September and October. Bright fall chinook enter the Columbia River over a longer period of time beginning in August and do not begin spawning until October with spawning observed into the following March in some locations. All lower Columbia River chinook mature from two to six years of age, primarily returning as three and four year old adults (Myers *et al.* 1998).

Spring chinook were present historically in the Sandy, Clackamas[a], Cowlitz, Kalama, Hood, White Salmon and Lewis rivers. Spawning and juvenile rearing areas have been eliminated or greatly reduced by dam construction on all these rivers. The native Lewis run became extinct soon after completion of Merwin Dam in 1932. The natural Hood River spring chinook population was extirpated in the 1960's after a flood caused by the natural breaching of a glacial dam resulted in extensive habitat damage in the West Fork production areas. Currently non-listed hatchery spring chinook from the Deschutes River are being released into the Hood River as part of a re-introduction program. The remaining spring chinook stocks in the Lower Columbia River ESU are found in the Sandy, Lewis, Cowlitz, and Kalama Rivers.

[a] Clackamas River spring chinook are considered part of the listed Upper Willamette River chinook ESU.

The WLC TRT tentatively identified 31 populations (20 fall (tule) run, 2 late fall run (brights) and 9 spring run) within the LCR chinook salmon ESU (Myers et al. 2002). Of the total 8 are considered to be extirpated. Dam construction eliminated habitat for a number of populations leading to their extirpation of spring chinook salmon populations: Upper Cowlitz River, Cispus River, Tilton River, North Fork Lewis, Big White Salmon, and Upper Cowlitz fall chinook and Big White Salmon fall chinook. The spring chinook population in the Hood River was also considered extirpated.

The tule fall chinook populations in the ESU are: Youngs Bay, Grays River, Big Creek, Elochoman River, Clatskanie River, Mill-Abernathy-Germany, Lower Cowlitz River, Coweeman River, Toutle River, Kalama River, Lewis River/ Salmon Creek, Washougal River, Clackamas River, Sandy River, Lower Gorge Tributaries, Upper Gorge Tributaries, Hood River, and Big White Salmon River. The late fall chinook populations are: Sandy River Late fall and Lewis River Late fall. The remaining spring chinook populations are: Toutle River, Kalama River, Lewis River, and Sandy River.

16.1.2 Current Status of the ESU

Numbers of naturally spawning spring-run chinook salmon are very low, and have historically had or continue to have significant contributions of hatchery fish. Hatchery-origin spring chinook are no longer released above Marmot Dam; the proportion of first generation hatchery fish in the escapement is thought to be relatively low, on the order of 10-20% in recent years. Recent average escapement of naturally spawning spring chinook adults in the Cowlitz, Kalama, and Lewis are 237, 198, and 364, respectively (LeFleur 2000, 2001). The amount of natural production resulting from these escapements is unknown, but is presumably small since the remaining habitat in the lower rivers is not the preferred habitat for spring chinook (ODFW 1998a). Hatchery escapement goals have been consistently met in the Cowlitz and Lewis Rivers. In the past, when necessary, brood stock from the Lewis was used to meet production goals in the Kalama. Although the status of hatchery stocks are not always a concern or priority from an ESA perspective, in situations where the historic spawning habitat is no longer accessible, the status of the hatchery stocks is pertinent.

Fall chinook populations in the Lower Columbia River are self sustaining and escapements are generally stable but at depressed levels (ODFW 1998). All medium and large tributaries to the Columbia River had native populations of fall chinook. Tule fall chinook are found in almost all Lower Columbia River basins. Escapements for these populations have averaged several hundred to 1000 per year. Tagging of hatchery fall chinook have shown that less than 10% of the spawning population in Mill, Germany, Coweeman, South Fork Toutle, East Fork Lewis, NF Lewis and Wind basins are hatchery spawners. In other basins natural spawning of tule fall chinook is thought to result primarily from hatchery-origin strays. The bright component of Lower Columbia River fall chinook spawn in the North Fork Lewis and East Fork Lewis, and Sandy rivers. Lower Columbia River bright stocks are among the few healthy natural chinook stocks in the Columbia River Basin. Escapement to the North Fork Lewis River has exceeded its escapement goal of 5,700 by a substantial margin every year since 1980, except 1999, with a recent five year average escapement of 8,400. Escapements of the two smaller populations of brights in the Sandy and East Fork Lewis River have been stable for the last 10-12 years and are largely unaffected by hatchery fish (NMFS 2001, ODFW 1998).

Freshwater habitat is in poor condition in many basins, with problems related to forestry practices, urbanization, and agriculture. Dam construction on the Cowlitz, Lewis, White Salmon, and Sandy Rivers has eliminated access to a substantial portion of the spring-run spawning habitat, with a lesser impact on fall-run habitat (Myers *et al.* 1998). The large numbers of hatchery fish in this ESU make it difficult to determine the proportion of naturally produced fish. In spite of the heavy impact of hatcheries, genetic and life-history characteristics of populations in this ESU still differ from those in other ESUs. However, the potential loss of fitness and diversity resulting from the introgression of hatchery fish within the ESU is an important concern. In response to concerns about straying into tributaries of the Lower Columbia (Myers *et al.* 1998), the release locations for non-ESU Rogue River bright fall-run fish in Youngs Bay were changed and as a result, stray rates have declined markedly.

16.2 ASSESSMENT OF THE HATCHERY PROGRAMS

There are 25 hatchery programs that release chinook salmon within the Lower Columbia River chinook salmon ESU (Table 1). Of this total, 16 programs release chinook salmon that are included in the Lower Columbia River chinook ESU (Table 1). The Hood River spring chinook program is considered to be integrated with the natural spawning population, which was derived from Deschutes River spring chinook, a non-LCR ESU population, since the native population the replaced the extirpated Hood River native population. Nine programs release chinook salmon that are not included in the ESU. The progeny of naturally spawning hatchery-origin fish from these programs are also not included in this ESU. All 25 of these programs are designed to mitigate for lost natural fish production associated with habitat degradation and the construction and operation of dams within the tributaries and the mainstem Columbia River.

Table 16.1. Historical population structure and artificial propagation programs for Lower Columbia River Chinook Salmon Populations.

Ecological Zone	Historic Population	Artificial Propagation Programs Integrated with Historic Population	Artificial Propagation Programs releasing non-ESU chinook salmon (segregated)	Included in ESU?	Program Release (smolt unless otherwise noted)	Year initiated
Coastal	Youngs Bay Fall Run		CEDC Select Area Brights (Rogue Fall Chinook) Program	No	1,450,000	1982
			CEDC Spring Chinook (Willamette Stock) Program	No	1,450,000	1989
			Astoria High School (STEP) Tule Fall Chinook Program. (Big Creek Hatchery Fall Chinook). (Fry release)	Yes	20,000	
			Warrenton High School (STEP) Tule Fall Chinook Program. (Big Creek Hatchery Fall Chinook) (Fry release)	Yes	7,500	
	Grays River Fall Run	Sea Resources Tule Fall Chinook Program		Yes	107,500	1996
			Deep River Net-Pens Spring Chinook (Cowlitz Salmon Hatchery stock) [Out of ESU]	No	200,000	1998
	Big Creek Fall Run	Big Creek Tule Fall Chinook Program		Yes	5,700,000	1941
	Elochoman River Fall Run	Elochoman River Tule Fall Chinook Program		Yes	2,000,000	1956
	Clatskanie River Fall Run	Big Creek Tule Fall Chinook Program		Yes	Included above	1941
	Mill Creek Fall Run					
	Scappoose Creek Fall Run					
Cascade	Upper Cowlitz Fall Run					
	Lower Cowlitz Fall Run	Cowlitz Tule Fall Chinook Program		Yes	5000000	1963
	Coweeman River Fall Run					
	Toutle River Fall Run	North Toutle Tule Fall Chinook Program		Yes	2,500,000	1953
	Kalama River Fall Run	Kalama Tule Fall Chinook Program		Yes	5,000,000	1895

Ecological Zone	Historic Population	Artificial Propagation Programs Integrated with Historic Population	Artificial Propagation Programs releasing non-ESU chinook salmon (segregated)	Included in ESU?	Program Release (smolt unless otherwise noted)	Year initiated
	Salmon Creek/Lewis River Fall Run					
	Clackamas River Fall Run					
	Washougal River Fall Run	Washougal River Tule Fall Chinook Program		Yes	4,000,000	1955
	Sandy River Early Fall Run					
	Lewis River Late Fall Run					
	Sandy River Late Fall Run					
	Upper Cowlitz River Spring Run	Cowlitz Spring Chinook Program*		Yes	822,000	1968/1999
		Friends of the Cowlitz Spring Chinook Program		Yes	55,000	
	Cispus River Spring Run	Cowlitz Spring Chinook Program*		Yes	Included above	1999
	Tilton River Spring Run	Cowlitz Spring Chinook Program*		Yes	Included above	?
	Toutle River Spring Run					
	Kalama River Spring Run	Kalama Spring Chinook Program		Yes	500,000	1959
	Lewis River Spring Run	Lewis River Spring Chinook Program		Yes	900,000	1960
		Fish First Spring Chinook Program (Lewis River stock)		Yes	150,000	
	Sandy River Spring Run	Sandy Spring Chinook Program		Yes	300,000	2002
Gorge	Lower Gorge Tributaries Fall Run		Bonneville Hatchery Fall Chinook (URB) Program	No	4,500,000	1991

Ecological Zone	Historic Population	Artificial Propagation Programs Integrated with Historic Population	Artificial Propagation Programs releasing non-ESU chinook salmon (segregated)	Included in ESU?	Program Release (smolt unless otherwise noted)	Year initiated
		Upper Gorge Tributaries Fall Run	Spring Creek NFH Tule Fall Chinook Program	Yes	15,175,000	1970 (remodel)
			Carson NFH Spring Chinook Program	No	1,678,000	1937
			Little White Salmon NFH Fall Chinook (URB) Program	No	2,000,000	1988
			Little White Salmon NFH Spring Chinook Program	No	1,050,000	1967
	Big White Salmon River Fall Run	Spring Creek NFH Tule Fall Chinook Program		Yes	Included above	
	Hood River Fall Run					
	Big White Salmon River Spring Run					
	Hood River Spring Run		Hood River Spring Chinook Program	No	125,000	
	* Additional 300,000 parr released into upper basin.					

16.2.1 Youngs Bay Tule Fall Chinook Population

16.2.1.1 CEDC (Clatsop Economic Development Commission) Select Area Brights Program

16.2.1.1.1 Broodstock History. The Select Area Brights (SAB) program is designed to be isolated from naturally spawning tule fall chinook. This program was derived from Rogue River fall chinook salmon and implemented to support early fall chinook terminal area fisheries in the Youngs. The SAB program fish were first reared and released at Big Creek Hatchery, but the 10 to 33 percent straying rate from this release location was deemed unacceptable (WDFW and ODFW 2003). SAB program chinook are still reared at Big Creek Hatchery, but releases are limited to the Klaskanine Hatchery and the Youngs Bay net pens. The broodstock for the program are from returns to the Klaskanine Hatchery and fish collected and held at the mouth of the Klaskanine River.

16.2.1.1.2 Similarity between Hatchery-origin and Natural-origin Fish. These fish (SABs) originate from outside the lower Columbia Chinook ESU, and the program is designed to be isolated from the reference population.

16.2.1.1.3 Program Design. Stream surveys in the Youngs Bay tributaries show that the majority of fall chinook spawning in the basins have been SABs, and the tule population is very depressed in these tributaries. Failure to achieve isolation of these fish poses a risk to the local chinook population and should prompt review of the program design. Stray rates into areas outside of Youngs Bay have been reduced to less than 2 percent for the 1995-98 brood years. The program currently marks 100 percent of the releases with a left ventral (LV) fin-clip. Some fish produced by the program receive an adipose and left ventral (ADLV) clip and/or a coded wire tag (CWT) combination.

The production goal for this program is to release 800,000 smolts (15/lb) from the Youngs Bay net pens and an additional 700,000 from the Klaskanine Hatchery. A concern with this program is collecting enough adults to support production goals. Stream flows in the Klaskanine River drive escapement to the hatchery. SAB fall chinook have been observed attempting to return to the hatchery prior to fall rains and dying from the effort. Currently, broodstock is collected and held in net pens near the mouth of the river, and when flows increase, broodstock collection can proceed at the hatchery.

16.2.1.1.4 Program Performance. The SAB program supports commercial and recreational fisheries in Youngs Bay. Adult returns from this program are not intended to spawn naturally. Smolt to adult survival rates for the program averaged 0.45% and ranged from 0.09% to 1.06% (broodyears 1993-98, date from Miller et al.2002). Commercial harvest of SAB fall chinook has ranged from 1,606 adults in 1996 to 9,723 adults in 2003. The program has no weirs or diversions that affect chinook migration or survival. This program is funded by a landing fee paid by terminal area commercial gill-netters, by ODFW R&E funds, and by BPA Fish and

Wildlife Program funds. This program is up for review, but continued funding of the program is likely.

16.2.1.1.5 Population Viability. Straying and gene flow among populations have the potential to alter a species' diversity. The local tule chinook population has declined to very small numbers, and strays from this program pose a risk to their characteristic diversity.

16.2.1.2 CEDC Spring Chinook Program

16.2.1.2.1 Broodstock History. This program uses spring chinook salmon from Willamette River hatcheries. Eggs are transferred to the Gnat Creek Hatchery for incubation and early rearing. Fingerlings are transported to net-pen facilities in Youngs Bay in November. Spring chinook for this program are also being released at CEDC's South Fork Klaskanine facility. This program is dependent on continued returns to Willamette River hatcheries.

16.2.1.2.2 Similarity between Hatchery-origin and Natural-origin Fish. Spring chinook salmon are not native to the lower Columbia River. This isolated program is designed to support commercial and recreational fisheries in terminal areas.

16.2.1.2.3 Program Design. Since 2001, all spring chinook releases have been adipose fin-clipped to allow for a selective fishery on hatchery-origin fish. It has been proposed that the program be expanded to increase these high-value benefits to terminal fisheries.

16.2.1.2.4 Program Performance. The stray rate for releases within Youngs Bay for brood years 1994-96 was 3.18 percent (Miller et al. 2002). The average survival rate for spring chinook released from the Youngs Bay net pens was 0.34 percent for the 1994-96 brood years (Miller et al. 2002). Program smolt-to-adult survival rates are better than those observed for the Willamette Basin hatchery releases of 0.24 percent (1993-96 brood years) due to their release location in the lower Columbia River. This program is supported by a landing fee paid by the commercial gill-netters, ODFW R&E funds, and the BPA Fish and Wildlife Program funds. This program is expected to continue, but it is up for review this year.

16.2.1.2.5 Population Viability. This program appears to be operating as designed and is not expected to affect the viability of the Youngs Bay tule fall chinook population. The release of spring chinook salmon into Youngs Bay and the South Fork Klaskanine River occurs prior to native fall chinook subyearling outmigration. Returning adults are not expected to impact tule fall chinook due to the lack of spring chinook holding and spawning habitat in Youngs Bay and its tributaries.

16.2.1.3 Astoria High School and Warrenton High School (STEP) Tule Fall Chinook Program (Fry releases).

16.2.1.3.1 Broodstock History. These are two small programs operated by local high schools for educational purposes. The Warrenton program has released fish into Skipanon River (a tributary to Youngs Bay) since 1996, and the Astoria program has released fish into the Youngs River

since the early 1990s. Eggs for these programs come from Big Creek Hatchery tule fall chinook, which are not part of the Youngs Bay population.

16.2.1.3.2 Similarity between Hatchery-origin and Natural-origin Fish. These programs are not designed to maintain similarities between hatchery-origin and natural-origin fish.

16.2.1.3.3 Program Design. The Astoria program and the Warrenton program release 20,000 and 7,500 fry, respectively. These programs are moderate in size, and are not expected to affect the native Youngs Bay tule fall chinook population. There are no plans to change the source of eggs for this program to tule fall chinook from Youngs Bay.

16.2.1.3.4 Program Performance. The Skipanon River is not surveyed for fall chinook, so it is unknown whether this program is producing returning adults. The fish released from these programs are not marked, so it cannot be determined if Youngs River releases are contributing to adult returns. Fry survival is generally low, and from these small releases, few adult returns would be expected. This program is funded through the Mitchell Act and ODFW. The continuation of this program is dependent on Mitchell Act funding.

16.2.1.3.5 Population Viability. These programs serve educational purposes and are viewed as important by the local community. The small size and design of the programs (fry releases) reduces the threat from the use of non-local fish for broodstock, but there are no data with which to assess any consequences.

16.2.2 Grays River Tule Fall Chinook Population

16.2.2.1 Sea Resources Tule Fall Chinook Program

16.2.2.1.1 Broodstock History. Fall chinook salmon are collected from the Chinook River as broodstock for this program. In 1996, the program reduced juvenile releases to levels consistent with habitat productivity in the Chinook River. The program is integrated with the natural population, but prior to 1996, fish from other LCR hatchery programs were released into the basin.

16.2.2.1.2 Similarity between Hatchery-origin and Natural-origin Fish. There are no data to determine whether returns to the Chinook River are diverged (genetically or in life history characteristics) from the Grays River population, but the program collects adults from throughout the run and should therefore be representative of the naturally spawning adults in the Chinook River.

16.2.2.1.3 Program Design. This is a conservation program with the goal of benefiting the viability of the Chinook River population. The broodstock goal is to collect no more than 50 percent of the total, aggregate of natural-origin and hatchery-origin adult return, passing the rest upstream of the weir to spawn naturally. The 2000 brood was mass marked with an adipose-clipped to allow for monitoring adult returns. It is currently unknown what proportion of the naturally spawning population is hatchery-origin fish. The current program is small, releasing a little over 100,000 subyearlings annually.

16.2.2.1.4 Program Performance. Fall chinook salmon from the program have been returning in increasing numbers since juvenile releases were sized to fit habitat conditions. Total returns have increased from a low of 48 in 2001 to a recent high of 200 in 2003 (Warren 2004). The cohort replacement rate for this program has not been calculated. Stray rates have not been determined for this program. Sea Resources is a non-profit education and fish restoration organization that obtains funding for the program from grant money. There is strong support for this and the other programs at the facility, but future funding is not certain. The program operates a weir to collect broodstock and monitor adult escapement, activities which may cause delay in adult upstream migration.

16.2.2.1.5 Population Viability. Fish released from this program are returning to spawn naturally. It is uncertain as yet if the Chinook River population is growing as a result. This program is also maintaining the spatial distribution of the Grays River fall chinook population.

16.2.2.2 Deep River Net Pens Spring Chinook Program

16.2.2.2.1 Broodstock History. There is no spring chinook population native to this area. Eggs for this program come from the Cowlitz Salmon Hatchery and the Lewis River Hatchery and are incubated and reared at the Grays River Hatchery. Fingerlings are transferred to the net pens and reared until release in late May.

16.2.2.2.2 Similarity between Hatchery-origin and Natural-origin Fish. This is an isolated program and is not designed to maintain similarities between hatchery-origin and any natural-origin fish.

16.2.2.2.3 Program Design. Program fish are released to support terminal fisheries and are intended to minimize impacts to local natural-origin populations. Since 2001, all releases (100 percent) of spring chinook have been adipose fin-clipped.

16.2.2.2.4 Program Performance. The stray rate for this program is unknown. The average survival rate for spring chinook released from the Deep River Net Pens is also unknown, but harvest of program fish has been very low, with only 117 adults caught in 2003 form a 1999 broodyear release of 159,563 yearlings. The cohort replacement rate for this program has not been calculated. This program, which is supported by a landing fee paid by the commercial gill-netters and BPA Fish and Wildlife Program funds, is up for review, though continued funding is anticipated.

16.2.2.2.5 Population Viability. This is an isolated program and is not expected to affect the viability of the Grays River tule fall chinook population. Interactions with local chinook populations are avoided, because juvenile releases occur prior to native all chinook subyearling outmigration. Returning adults are not expected to impact tule fall chinook because of the lack of spring chinook holding and spawning habitat in Grays River tributaries.

16.2.3 Big Creek Tule Fall Chinook Population

16.2.3.1 Big Creek Tule Fall Chinook Program

16.2.3.1.1 Broodstock History. Originally, this program was not considered to be included in the ESU because of questions about whether Rogue River bright fall chinook (SABs) were incorporated into the tule broodstock. To prevent their incorporation into the tule program, all SABs released at Big Creek Hatchery were uniquely marked. The SABs also had different return timing and different morphology from the tule population. Based on this information, there is a high degree of certainty that only fall chinook included in the ESU have been used for broodstock. It should be noted that, in the past, natural-origin adults from Plympton Creek (Clatskanie River population) were incorporated into Big Creek tule broodstock. Currently, only program hatchery-origin and natural-origin fish returning to Big Creek Hatchery are used for broodstock. This program is considered integrated, since both natural-origin and hatchery-origin fall chinook are used for broodstock. However, because of low marking rates, it is impossible to distinguish natural-origin and hatchery-origin returns and the extent of broodstock integration.

16.2.3.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The Big Creek natural population has been subjected to high levels of hatchery-origin fish on the spawning grounds (swamping effects since 1941) in addition weir operations have adversely affected escapement into the watershed. There are no genetic or life history data available to assess the similarity of hatchery-origin and natural-origin fish.

16.2.3.1.3 Program Design.
This program is designed to support commercial and recreational fisheries. Currently, no fall chinook are allowed to spawn in areas above the weir at the Big Creek Hatchery. Broodstock is collected at the weir and program chinook salmon are reared and released on-station. This is a very large program with a goal of releasing 5,700,000 subyearlings annually. Less than 10% of the annual releases are marked with a CWT and adipose fin-clip. Currently fall chinook are not passed above the weir but coho and winter steelhead are released upstream. ODFW is managing the upper basin to support coho, a species listed by the state of Oregon, and may pass chinook in the future.

16.2.3.1.4 Program Performance. Stray rates are a concern. Big Creek tule fall chinook have been recovered in Bear Creek, Gnat Creek, Plympton Creek, and in lower Big Creek. Straying into Bear and Gnat creeks was less than 10 percent in 2002 and 2003 (Fulop 2003) but has been greater than 50 percent in Big Creek. The smolt-to-adult survival for this program averaged 0.33 percent for the 1992-96 broodyears. Cohort replacement rates have not been calculated. This program is 100-percent funded through the Mitchell Act, and future funding is uncertain. The program is currently under-funded, and it has a large backlog of maintenance needs.

16.2.3.1.5 Population Viability.
The Big Creek tule fall chinook program is expected to have a detrimental effect on the reference population due to the elimination of the habitat above the weir, and the overwhelming number of hatchery spawners in the lower Big Creek. However, the program does supporting the naturally spawning adults in Big Creek and adjacent tributaries that may not be self-sustaining without the

hatchery contribution. The program has also maintained the spatial distribution of the reference population.

16.2.3.2 CEDC Spring Chinook Salmon Program (Blind Slough and Tongue Point)

16.2.3.2.1 Broodstock History. This is an isolated program that is dependent on spring chinook salmon from Willamette River hatcheries.

16.2.3.2.2 Similarity between Hatchery-origin and Natural-origin Fish. Spring chinook salmon are not native to this area of the lower Columbia. This isolated program is designed to support commercial and recreational fisheries in terminal areas.

16.2.3.2.3 Program Design. Fish from this program are not intended to spawn naturally. Eggs are transferred to the Gnat Creek Hatchery for incubation and early rearing. Fingerlings are transported to net-pen facilities at Blind Slough and Tongue Point in November. High stray rates led to the end of spring chinook releases from the Tongue Point net pens in 2000. In 2003 and 2004, small releases of 60,000 smolts began to test a new release location in the Tongue Point area (MERTs Dock) that is further upstream in Cathlamette Bay from the mainstem Columbia River. It is hoped that this new release location will minimize straying. Since 2001, all releases of spring chinook have been 100-percent adipose fin-clipped.

16.2.3.2.4 Program Performance. The stray rate for releases from Blind Slough net pens for brood years 1994-96 was 1.2 percent (Miller et al. 2002). The stray rate for spring chinook releases from the Tongue Point net pens was 24.71 percent for the same broodyears. The average survival rate for spring chinook released from the Blind Slough and Tongue Point net pens was 0.21 percent and 0.23 percent for the 1994-96 brood years, respectively (Miller et al. 2002). This compares with an average smolt-to-adult survival rate for Willamette Basin hatchery releases of 0.24 percent for the 1993-96 brood years. This program is supported by a landing fee paid by the commercial gill-netters, ODFW R&E funds, and BPA Fish and Wildlife Program funds. This program is up for review, but continued funding is anticipated.

16.2.3.2.5 Population Viability. This is an isolated program and is not designed to benefit any chinook population's viability. Spring chinook salmon are released from net pens prior to nearby fall chinook subyearling outmigrations. Returning adults are not expected to impact tule fall chinook due to the lack of spring chinook holding and spawning habitat in Big Creek and area tributaries.

16.2.4 Clatskanie River Fall Chinook Population

16.2.4.1 Big Creek Hatchery Fall Chinook

16.2.4.1.1 Broodstock History. Currently, only hatchery-origin and natural-origin fish returning to Big Creek hatchery are used for broodstock (origin cannot be distinguished at the weir due to low marking rates for fall chinook). It should be noted that, in the past, naturally produced adults from Plympton Creek (Clatskanie River population) were incorporated into Big Creek tule broodstock.

16.2.4.1.2 Similarity between Hatchery-origin and Natural-origin Fish. Big Creek fall chinook originate from another fall chinook population included in the ESU. No data (genetic or life history) are available to compare Clatskanie River and Big Creek program chinook.

16.2.4.1.3 Program Design.
This program is designed to support commercial and recreational fisheries. These fish are not intended to spawn naturally. Less than 10% of the annual releases are marked with a CWT and adipose fin-clip.

16.2.4.1.4 Program Performance. Big Creek program fish stray into Plympton Creek but account for less than 5 percent of the escapement (Fulop 2003).

16.2.4.1.5 Population Viability. This program may have a detrimental effect on the genetic diversity of Clatskanie tule fall chinook. Monitoring efforts have shown that Big Creek program fish (originating outside the population) stray into Plympton Creek.

16.2.5 Elochoman River Fall Chinook Population

16.2.5.1 Elochoman River Fall Chinook Program

16.2.5.1.1 Broodstock History. The Elochoman Hatchery fall chinook program currently collects adults returning to the Elochoman River at a temporary weir located at RM 3, just above tidewater. Flows are generally too low for fish to reach the hatchery at RM 11.1 before October. The program should be considered integrated, because it collects both hatchery-origin and natural-origin fall chinook at the weir. Historically, the broodstock for the program has included mostly returning Elochoman hatchery-origin fish but has also included numerous transfers from other within-ESU fall chinook hatchery programs. The most recent transfer was from the Washougal Hatchery in 2001. Since that time, the Elochoman Hatchery program has been using only returns to the basin. The proportion of natural-origin and hatchery-origin returns incorporated into the broodstock is unknown, because hatchery-origin fish are not 100-percent marked.

16.2.5.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The degree to which current returns represent the historical population is uncertain due to the large number of hatchery releases since the program began in 1956. These releases have had a considerable effect on the natural spawning population, making up over 40 percent of the naturally spawning adults in the basin. The current hatchery program probably best represents what is spawning naturally in the basin.

16.2.5.1.3 Program Design. The program goal was originally to support ocean and in-river fisheries, but more recently, it has adopted the goal of supporting the naturally spawning population in the Elochoman River. As a result, management will not allow the use of out-of-basin tule fall chinook to supplement the program if broodstock goals are not achieved. The proportion of program fish on the spawning grounds has ranged from 40 to 90 percent in recent years. The number of natural-origin fall chinook incorporated into the broodstock is unknown,

but WDFW has proposed additional monitoring to determine the proportion of natural-origin fall chinook on the spawning grounds and in the broodstock. The monitoring will require additional funding.

16.2.5.1.4 Program Performance. Stray rates for the program have not been estimated but are a concern. Smolt-to-adult survival rates averaged 0.13 percent for the 1992-96 broodyears. Returns to the hatchery have ranged widely over recent years from a low of 709 in 1996 to a recent high of 3,883 in 2001. Cohort replacement rates have not been calculated. This program is 100-percent funded through the Mitchell Act, and future funding is uncertain. The program is currently under-funded, and it has a large backlog of maintenance and monitoring needs. The weir at the Elochoman Hatchery was breached in 2002, and minor repairs have been made; however, problems still impact the ability to collect adults and monitor escapement.

16.2.5.1.5 VSP Effects. The Elochoman tule fall chinook program has increased the number of natural spawners in the Elochoman River and potentially in nearby tributaries. The program probably supports the abundance of the reference population but may have an unknown effect on diversity because of the past incorporation into the program of eggs and juveniles from outside the reference population. The practice of filling program shortages with eggs from other programs has been restricted, so the required use of only fall chinook returning to the hatchery will support the development of local broodstock for the program.

16.2.6 Lower Cowlitz Fall Chinook Population; Upper Cowlitz Fall Chinook Population

16.2.6.1 Cowlitz Tule Fall Chinook Program

16.2.6.1.1 Broodstock History. Fall chinook that historically spawned in the upper Cowlitz River basin have been incorporated into the broodstock along with fall chinook from the lower Cowlitz River fall chinook population. The hatchery uses adults returning to the Cowlitz Salmon Hatchery for broodstock and has incorporated very little production from outside the basin. Those fall chinook that were released into the basin were from within the ESU.

16.2.6.1.2 Similarity between Hatchery-origin and Natural-origin Fish. There is some uncertainty as to whether the current hatchery-origin fall chinook represent the historical populations, because the program has combined adults from both the Upper Cowlitz River and Lower Cowlitz River fall chinook populations. There are natural-origin spawners in the mainstem Cowlitz River and lower Cowlitz River tributaries below the hatchery facility, but the influence of hatchery-origin fish has been considerable. In some years, up to 90 percent of the naturally spawning adults have been hatchery-origin fall chinook (W/LCR TRT 2002). In recent years with higher natural-origin returns, the proportion of hatchery-origin fish spawning naturally has declined to less than 20 percent (W. Dammers, WDFW, *pers. comm.).*

16.2.6.1.3 Program Design. This is a 5,000,000-subyearling release program designed to contribute to fisheries and conserve/recover the local fall chinook population as mitigation for hydrosystem impacts and habitat loss. The program is integrated, though the proportion of natural-origin tule fall chinook used in the broodstock is unknown, because not all hatchery-

origin fall chinook are marked. This program has been used in efforts to re-introduce fall chinook into historical areas in the upper Cowlitz River basin. Adult fall chinook were released above Cowlitz Falls Dam (the uppermost dam) in 2001 (2,822) and 2002 (5,682). In surveys in the upper Cowlitz and Cispus rivers in 2002, 144 fall chinook redds were observed. The reintroduction was discontinued in 2003 and will be delayed until spring chinook reintroduction efforts have been evaluated. Naturally reproducing spring chinook in the upper Cowlitz basin are outmigrating as subyearlings, so continued release of fall chinook into the upper basin will confound efforts to evaluate spring chinook production.

16.2.6.1.4 Program Performance. Stray rates for the program have not been estimated but are a concern. Smolt-to-adult survival rates have been very low, averaging 0.08 percent for broodyears 1992-1996. Returns to the hatchery have increased from an average 3,684 for the years 1996-2000 to over 11,000 in 2003. This program is funded by Tacoma Public Utilities as mitigation for hydro-system operation in the Cowlitz River basin and is expected to be funded for the life of the project license. The hatchery program size and implementation will be adjusted during negotiations on the development of Fish Hatchery Management Plan for the Cowlitz River basin. The low survival rate observed for hatchery-origin spring chinook is in part due to poor conditions at the hatchery. These deficiencies are expected to be addressed as part of a hatchery remodel that is required under the new license agreement.

16.2.6.1.5 VSP Effects. This program has increased and maintained the number of naturally spawning fall chinook in the lower Cowlitz River. It probably supports the abundance of the reference population, but it has affected diversity in the basin by combining the populations that were historically present in the Cowlitz River. The program has used only Cowlitz River returns, except for minor transfers into the program of within-ESU stocks in the past. This program represents the genetic resource for fall chinook in the basin and for future reintroduction efforts into the upper Cowlitz River basin.

16.2.7 Toutle River Fall Chinook Population

16.2.7.1 North Toutle Tule Fall Chinook Program

16.2.7.1.1 Broodstock History. After the eruption of Mt. St. Helens, fall chinook production was reestablished through recolonization and introduction of fall chinook from within-ESU hatcheries. An adult picket weir barrier is maintained on the Green River at the N.F. Toutle River hatchery location to collect adults. The program has been using returns to the basin since 1996, except for a release of fall chinook from the Elochoman Hatchery in 2000. It is uncertain how well the program is integrated with the natural-origin population in the Green River. The hatchery-origin fish are marked at a low rate (3.5 percent) and thus cannot be distinguished from natural-origin adults at the weir, so the proportion of natural-origin fish used in the broodstock is unknown.

16.2.7.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The current program may not represent the natural-origin fall chinook in the Toutle River population, because the program does not release fall chinook at the same size or life history stage as the natural-origin fish. Furthermore, the Toutle River basin is very large and has major tributaries that are not

directly influenced by the hatchery fall chinook. This program may better represent the fall chinook that return to the Green River basin.

16.2.7.1.3 Program Design. The purpose of the program is to contribute to harvest and conserve/recover Toutle River fall chinook. In principle, the program will be operated to mimic the natural-origin Green River/Toutle River fall chinook. To do this, the program uses returning adults to the Green River collected at the weir for broodstock and will use best management practices (BMPs) for rearing and release. This is an integrated program, though the proportion of natural-origin tule fall chinook used in the broodstock is unknown, because not all hatchery-origin fall chinook are marked. Out-of-basin transfers into the hatchery do not occur except in extreme situations and must be approved by WDFW's Regional Fish Program Manager. An interim minimum escapement goal of 500 adults was established for fall chinook above the weir. The annual production goal for this program is a release of 2,500,000 subyearlings.

16.2.7.1.4 Program Performance. Returns to the Green River have reflected increases in fall chinook returns in other LCR populations. The preliminary estimate of natural spawners in 2003 was 13,806 adults, an increase from an average return of 1,751 for the years 1993-2002. These returns are in addition to the number of adults collected for broodstock. Smolt-to-adult returns have improved from an average of 0.089 percent for the 1992-96 broodyears. Straying of program fish into other basins has not been estimated. This program is 100-percent funded through the Mitchell Act, and future funding of this program is uncertain. The program is currently under-funded, and it has a large backlog of maintenance and monitoring needs. The weir and sorting facility needs to be upgraded to better handle returning adult fall chinook and coho salmon. The low number of marked adults makes monitoring natural- and hatchery-origin adult spawning difficult.

16.2.7.1.5 VSP Effects. The program supports the number of naturally spawning fall chinook in the reference population but may have an unknown effect on diversity because of the incorporation of eggs and juveniles from outside the reference population into the program after the eruption of Mt. St. Helens. In addition, this program is designed to mimic Green River fall chinook, a sub-population of the Toutle River fall chinook population, and help maintain the diversity and spatial distribution of the ESU. The practice of filling program shortages with eggs from other programs has been restricted, so the required use of only fall chinook returning to the hatchery will support the development of local broodstock for the program.

16.2.8 Kalama River Fall Chinook Population

16.2.8.1 Kalama Tule Fall Chinook Program

16.2.8.1.1 Broodstock History. The broodstock for the program is collected at the Modrow weir at RK 4.8 and at the Kalama Falls Fishway trap. The weir is operated from August 1 to October 1. Only 3.5 percent of the hatchery-origin fall chinook are marked, and thus the origin of returning fall chinook cannot be determined. The proportion of natural-origin fall chinook that is incorporated into the broodstock is unknown. There have not been any transfers of out-of-basin fall chinook since 1984, when the hatchery was used as an egg-bank program for Snake River

fall chinook. These fish were uniquely marked and segregated from the Kalama River fall chinook program.

16.2.8.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The goal of the program is to mimic the natural-origin fall chinook in the Kalama River, but evidence has shown that the return timing and median spawning date have increased compared to returns observed prior to 1953 (Fuss *et al.* 1998). This may have been an artifact of broodstock collection activities or habitat changes in the lower Kalama River.

16.2.8.1.3 Program Design. The program is funded to provide for harvest and to conserve/recover Kalama River fall chinook. The interim minimum escapement goal is to pass 400 to 450 adults above the weir at Modrow to spawn naturally from the weir to below Kalama Falls. The weir is not 100-percent effective and additional adults escape to spawn naturally. This is an integrated program, though the proportion of natural-origin tule fall chinook used in the broodstock is unknown, because not all hatchery-origin fall chinook are marked. The production goal for the program is 5,000,000 subyearlings released at Kalama Falls Hatchery and at Fallert Creek Hatchery. The program currently uses BMPs but must increase marking to better monitor the status of natural-origin fall chinook.

16.2.8.1.4 Program Performance. The program has been meeting production goals for over 20 years. The number of natural spawners has increased recently to an estimated 24,710 in 2003. This is an increase from a low of 1,420 observed in 2000. Straying of program fish into other basins has not been estimated. This program is 100-percent funded through the Mitchell Act, and future funding is uncertain. The program is currently under-funded, and it has a large backlog of maintenance and monitoring needs. The Modrow weir and trap need to be upgraded to address handling conditions for salmon and steelhead collected in the trap during broodstock collection activities.

16.2.8.1.5 VSP Effects. The program probably supports the number of naturally spawning fall chinook in the reference population. The practice of filling program shortages with eggs from other programs has been restricted, so the required use of only fall chinook returning to the hatchery will support the development of local broodstock for the program.

16.2.9 Washougal River Fall Chinook Population

16.2.9.1 Washougal Tule Fall Chinook Program

16.2.9.1.1 Broodstock History. Broodstock for this program has come primarily from returns to the hatchery, though out of basin stocks have been released in the basin. The last transfer of fish into the basin was in 2000 with fish from the Elochoman Hatchery.

16.2.9.1.2 Similarity between Hatchery-origin and Natural-origin Fish. There are not expected to be any differences between the hatchery-origin and natural-origins fall chinook in the basin, considering that up to 80 percent of the naturally spawning adults are hatchery-origin. The Washougal fall chinook population is genetically unique and has a later run-timing than other fall chinook populations in the LCR chinook ESU.

16.2.9.1.3 Program Design. The production goal for the program is a release of 4,000,000 subyearling fall chinook at the hatchery annually. This is an integrated program, though the proportion of natural-origin tule fall chinook used in the broodstock is unknown because not all hatchery-origin fall chinook are not marked. A new management goal has just recently been implemented that will prevent the use of out of basin tule fall chinook to supplement the program if broodstock collection goals are not achieved. An escapement goal has not been established, but the number of naturally spawning adults has averaged over 3,600 since 1999. All releases are currently from the hatchery at the upper end of the basin. There is a proposal to release a portion of the production in future years from a location in the lower river to improve fishing opportunities and to increase the spawning distribution within the basin.

16.2.9.1.4 Program Performance. Smolt-to-adult survival has averaged 0.17 for the 1990-94 broodyears. Stray rates for fall chinook released from Washougal Hatchery have been high, with 27 percent of the recoveries in basins other than the Washougal. This program is 100 percent funded through the Mitchell Act, and future funding of this program is uncertain. The program is currently under-funded and it has a large backlog of maintenance and monitoring needs.

16.2.9.1.5 VSP Effects. The program probably supports the abundance of the reference population, considering the estimated proportion of hatchery-origin fish spawning naturally. The program may have an unknown effect on diversity because of the incorporation of eggs and juveniles from outside the reference population into the program. The practice of filling program shortages with eggs from other programs has been restricted, so the required use of only fall chinook returning to the hatchery will support the development of local broodstock for the program.

16.2.10 Upper Cowlitz River Spring Chinook Population; Cispus River Spring Chinook Population; Tilton River Spring Chinook Population

16.2.10.1 Cowlitz Spring Chinook Program

16.2.10.1.1 Broodstock History. Access to the historical habitat for the Tilton, upper Cowlitz and Cispus populations is currently blocked by Mayfield Dam. Since the construction of the dam in 1963, returning adults from all three populations have been incorporated into the broodstock at the Cowlitz Salmon Hatchery. The Cowlitz Salmon spring chinook program has rarely released spring chinook salmon from outside the basin, with the last release in 1970 from the Little White Salmon NFH. The Cowlitz Spring Chinook program releases spring chinook parr and adults into the upper Cowlitz River basin in an attempt to re-establish a natural spawning population above Cowlitz Falls Dam in the upper Cowlitz and Cispus rivers. Currently, natural-origin spring chinook are not incorporated into the broodstock, and all unmarked adults are transported into the upper Cowlitz River.

16.2.10.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The hatchery-origin spring chinook population represents the remaining genetic resource in the basin. There is very limited natural spawning in the Lower Cowlitz River (average of 169 fish from 1980-96), and these are probably hatchery-origin spring chinook. Prior to dam construction, hatchery records

from 1927-1945 showed that eggs were collected a month earlier than the current spawning time at Cowlitz Salmon Hatchery. Collection at Cowlitz Falls Dam has observed both subyearling and yearling migrants. Currently the hatchery-origin adults are all released as yearling migrants.

16.2.10.1.3 Program Design. The Cowlitz spring chinook program was implemented to replace native fish production lost due to the construction of dams in the Cowlitz River basin. During the recent relicensing process for the dams on the Cowlitz River, a primary goal under the new license was to re-establish natural spawning populations in the upper basin above the dams. These reintroductions will be evaluated to determine if volitional passage should be reinstated. The final design on these programs is being negotiated through the development of a Fish Hatcheries Management Plan for the Cowlitz River basin. These programs are funded by Tacoma Public Utilities as mitigation for impacts of the hydro-system. In the reintroduction program, a portion of the unmarked, naturally produced spring chinook salmon and those spring chinook salmon adults returning from releases in the upper basin are collected and hauled upstream of the dams to spawn naturally. Some of these are used for broodstocks in the hatchery. All hatchery releases are adipose-clipped, except those that are released above Cowlitz Falls are given a right ventral fin-clip. There have been no releases into the Tilton River, but releases are proposed for the future. Releases in the Tilton River at this time would confound the evaluation of juvenile passage through the dams, because subyearling and parr spring juveniles produced in the upper basin are being collected at Mayfield Dam. If production were coming from the Tilton River and collected at Mayfield Dam, returning adults could not be separated between the Tilton and upper Cowlitz rivers when they are collected at the barrier dam. In the future, natural-origin adults will be incorporated into the hatchery broodstock.

16.2.10.1.4 Program Performance. Stray rates for this program have not been estimated. Studies and returning adults show that hatchery-origin fish outplanted above the dams do spawn and produce progeny. However, high mortality rates have been observed for juvenile fish emigrating through the dam facilities, and that will limit natural production above the dams. Spring chinook releases began in 1999, when 91 adults and 177 jacks were passed upstream. This number has grown to 559 unmarked and 8,030 hatchery adults in 2003. These programs have benefited from the strong returns to the hatchery in recent years. Smolt-to-adult survival of smolts released at the hatchery has averaged 0.36 percent for the 1994-98 broodyears. The survival of subyearling releases averaged less than 0.03 percent for releases from the hatchery in the early 1990s. It can be expected that survival for releases in the upper basin will be less, due to impacts from passage through the hydro-system. The low survival rates observed for hatchery-origin spring chinook is in part due to poor conditions at the hatchery. These deficiencies are expected to be addressed as part of a hatchery remodel that is required under the new license agreement.

16.2.10.1.5 VSP Effects. This program as implemented is expected to increase the number of naturally spawning adults, and increase the diversity and spatial distribution of the reference populations. One issue that has yet to be resolved with the spring chinook populations in the Upper Cowlitz, Cispus and Tilton rivers is whether they will differentiate into unique populations representative of their historical distribution once passage issues are addressed. Also an issue is how to integrate the Cowlitz Hatchery spring chinook program to support up to three populations in the Cowlitz River basin. Reintroducing fish above the dams may also benefit life history and spatial diversity of the ESU. Monitoring and evaluation activities are ongoing to

determine the effect of naturally spawning hatchery chinook salmon on the productivity of natural populations and their potential to support reintroduction efforts.

16.2.10.2 Friends of the Cowlitz Spring Chinook Program

The Friends of the Cowlitz spring chinook program releases Cowlitz program spring chinook from a net pen into the lower Cowlitz River. This is a WDFW cooperative program with a local fishing group and is designed to spread out the harvest opportunities in the lower Cowlitz River. This program is being monitored to determine contribution of these fish to harvest and returns. It is unknown what the effects of this program are on the reference population, but they are expected to be minor or neutral.

16.2.11 Kalama River Spring Chinook Population

16.2.11.1 Kalama Spring Chinook Program

16.2.11.1.1 Broodstock History. The program uses returning adult spring chinook that are collected at the Kalama Falls Fishway trap. The program was started in 1959, and a number of different hatchery stocks have been used over the years. The program has been self-sufficient since the early 1980s, except for two releases of spring chinook from the Lewis River. The current management supports the development of local broodstock for the program.

16.2.11.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The program may have adversely affected the reference population by inclusion of non-local stocks into the program, primarily from the Lewis River. The BRT contends that the Kalama River historically probably did not support a population of spring chinook, even though it is within the range of the ESU. The W/LCR TRT (2003) cited data from WDFW suggesting that there was a spring chinook run in the basin. Genetic analysis suggests that the Kalama River spring chinook are more similar to Cowlitz River spring chinook (W/LCR TRT 2003). The Kalama River spring chinook program supports the reference population, contributing an estimated 80 percent of the natural spawners annually.

16.2.11.1.3 Program Design. The purpose of the program is to support fisheries in the basin and lower Columbia River and to conserve the spring chinook population in the Kalama River. To address the first goal, all spring chinook from the basin are adipose fin-clipped to allow for selective harvest. The production goal is 500,000 smolts, with half the production released at Gobar Pond in the upper basin and the remainder at the Fallert Creek facility in the lower river. There is a minimum escapement goal for spring chinook above Kalama Falls of 500 adults, but the program has not met integration goals; over 80 percent of the natural spawners are hatchery adults.

16.2.11.1.4 Program Performance. Stray rates for this program have not been estimated. Adult returns to the facility have been increasing from a recent low of 347 in 1998 to a return of 3,663 in 2003 (preliminary). The 100-percent marking rate has allowed for the identification of naturally produced adult spring chinook returning to the basin. In 2002 and 2003, unmarked adult returns were estimated at132 and 214, respectively, and all were released upstream to

spawn naturally. In those same years, hatchery spring chinook that were surplus to broodstock needs were either released upstream to spawn or downstream to allow for further harvest opportunities. The minimum escapement was exceeded in these years above the falls. The Kalama River spring chinook program needs to develop a plan to incorporate natural-origin spring chinook into the broodstock as returns increase, as well as monitor the proportion of hatchery-origin adults spawning naturally. The smolt-to-adult survival rate averaged 0.24 percent for the 1989 to 1998 broodyears, ranging from a low of 0.05 percent to a high of 0.58 percent. This program is 100-percent funded through the Mitchell Act, and future funding of this program is uncertain. The program is currently under-funded, and it has a large backlog of maintenance and monitoring needs. The water supply and hatchery facility requires updating to meet NOAA fisheries criteria and to meet production goals and quality smolt needs. In addition, the current barrier at Kalama Falls Hatchery has been breached and needs repair, severely hampering efforts to monitor returning adults.

16.2.11.1.5 VSP Effects. This program is supporting the naturally spawning population of spring chinook in the Kalama River basin, making up an estimated 80 percent of the natural spawners in some years. Recent estimates show naturally produced adults are returning to the basin. Marking all hatchery production will permit monitoring. The program has maintained population diversity by using returns to the Kalama River basin, and the program spring chinook are representative of the reference population. Only Lewis River spring chinook have been released into the basin to supplement poor broodyears in 1996 and 1998.

16.2.12 Lewis River Spring Chinook Population

16.2.12.1 Lewis Spring Chinook Program

16.2.12.1.1 Broodstock History. Historically spring chinook spawned in the upper North Fork Lewis River, but this production was lost in 1931 when Merwin Dam was completed. Spring chinook do not utilize the East Fork of the Lewis River. Currently, the program is made up of adults returning to the hatchery and has incorporated Cowlitz Hatchery and Kalama Falls Hatchery spring chinook into production to meet shortages in the past. The last release of non-Lewis River spring chinook was in 1993; since then, all broodstock has been from returning adults. Hatchery returns are collected at the Lewis River Hatchery and Merwin traps.

16.2.12.1.2 Similarity between Hatchery-origin and Natural-origin Fish. After construction of Merwin Dam, the naturally produced spring chinook declined to their current depressed status, being almost wholly supported by the hatchery program. The Lewis River spring chinook program has provided an estimated 80 percent of the natural spawners to the reference population. Lewis River spring chinook are similar genetically to Cowlitz River and Kalama River spring chinook and also associate with Sandy River spring chinook (W/LCR TRT 2003).

16.2.12.1.3 Program Design. The WDFW has managed this program primarily to support harvest as mitigation for impacts from the construction and operation of the dams on the Lewis River. The program marks 100 percent of the production with an adipose fin clip to allow for selective fisheries. The production goal is to release 900,000 smolts. The spring chinook are

spawned and reared at the Speelyai Hatchery and then acclimated at the Lewis River hatchery prior to release.

The historical spring chinook habitat was above Merwin Dam. Very little habitat for spring chinook is located in the lower river, so management has not supported an integrated program. This management strategy will change as part of the relicensing process for the dams in the basin. Reintroduction of spring chinook into the upper Lewis River will be attempted and will comprise spring chinook from this program. There are plans to develop and integrate the hatchery program with the naturally produced population. There is concern that fish released from this program can negatively impact the naturally produced fall chinook population in the lower N.F. Lewis River. This is the only naturally self-sustaining population that can be considered viable within the LCR chinook ESU and needs to be protected. Spring chinook are released as smolts and during periods of high flow to aid migration and reduce impacts.

16.2.12.1.4 Program Performance. Stray rates for this program have not been estimated. Escapements to the basin have increased in numbers similar to other spring chinook in the ESU. Returns to the hatchery have averaged 1,354 from 1999-2003. The marking of all hatchery production has allowed for an assessment of the number of naturally produced spring chinook returning to the basin. In 2002, 90 unmarked adults were collected; this increased to an estimated 253 in 2003. These unmarked fish were released below the hatchery, though some spring chinook have been released above the dams in the Lewis River. The smolt-to-adult survival of program fish averaged 0.188 percent for the 1994-98 broodyears. The program is funded by Pacificorp as mitigation for the construction and operation of the Lewis River dams. The program and the hatchery facilities are expected to be modified as part of the dam relicensing process.

16.2.12.1.5 VSP Effects. This program has probably provided a net benefit by maintaining a naturally spawning population in the basin and the diversity and spatial distribution of the reference population.

16.2.12.2 Fish First Spring Chinook Program

The program acts as an additional release location for the Lewis River spring chinook program. This program is a WDFW cooperative rearing program involving Fish First, a fishing group in the Lewis River basin. This program rears and releases Lewis River program spring chinook in net pens downstream of the hatchery to spread out fishing opportunities in the lower river. The net pen site is situated near native fall chinook spawning areas, and there is a concern that spring chinook may adversely impact the fall chinook. Monitoring has determined that smolts from the program emigrate quickly. Very few hatchery-origin spring chinook are collected during fall chinook seining operations. Straying rates from this program have not been determined, and additional monitoring and evaluation has been proposed. This program is expected to have similar effects on the Lewis River spring chinook population as the Lewis River spring chinook program.

16.2.13 Sandy River Spring Chinook Population

16.2.13.1 Sandy Spring Chinook Program

16.2.13.1.1 Broodstock History. This is a new program that was started in 2002 when all returning hatchery spring chinook were marked, allowing for the selection of naturally produced adults for broodstock. The new program replaces the releases of Clackamas River spring chinook that occurred until 2003.

16.2.13.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The broodstock for this program has been derived from returning unmarked spring chinook salmon, so there should be no difference between the hatchery-origin and natural-origin spring chinook. A genetic analysis determined that naturally spawning spring chinook were intermediate to Clackamas River spring chinook and LCR spring chinook stocks. The analysis also determined that there was little genetic resemblance to the fall chinook run to the Sandy River. This is counter to trends observed in other LCR basins. Even with the potential interbreeding with Clackamas River spring chinook, the naturally spawning spring chinook still retained some original genetic characteristics (W/LCR TRT 2003). Spring chinook are not reared in the Sandy River basin but are spawned and reared at the Clackamas Hatchery and acclimated to the Sandy River at Sandy Hatchery.

16.2.13.1.3 Program Design. The Sandy River spring chinook program could be used to increase abundance of spring chinook in the Sandy River, but it is currently being used only to augment harvest. Returning hatchery fish from this program and past Clackamas River releases are currently removed at Marmot Dam and prevented from spawning naturally. Removal of all hatchery adults will prevent the non-ESU spring chinook Clackamas River spring chinook from contributing to the naturally spawning population and limit any potential impacts from the new local broodstock program. The Clackamas River spring chinook will no longer be coming back to the basin after 2007, when Marmot Dam and the trapping facility will be removed. Spring chinook from the Sandy River program will be monitored to determine the contribution of hatchery fish in the spawning population in the upper Sandy River Basin. If hatchery contribution levels exceeds goals set by ODFW, the program will be modified.

16.2.13.1.4 Program Performance. This is a new program with the first release occurring in 2003. Unmarked spring chinook returns at Marmot Dam were 1,275 in 2002 and 1,151 in 2003, returns in 2004 are expected to be of similar magnitude. This program is 100-percent funded through the Mitchell Act, and future funding is uncertain. The program is currently under-funded, and it has a large backlog of maintenance and monitoring needs. Passage above the hatchery into Cedar is blocked by the hatchery weir and intake structure, preventing use of upstream natural habitat for coho and winter steelhead. The intake structure will need to be upgraded. A method needs to be developed to address disease concerns with fish in the water supply. These issues will have an impact on production at the Sandy Hatchery.

16.2.13.1.5 VSP Effects. This spring chinook program can potentially provide conservation benefits by increasing the number of naturally spawning adults in the Sandy River, if additional adults are needed to supplement the natural population. The marking of all hatchery production

has allowed for better estimates of the status of the naturally produced population in the basin. This program has improved the genetic diversity of the population by eliminating the use of non-local chinook salmon for harvest augmentation and by using unmarked adults for broodstock. This program also will help maintain the spatial structure.

16.2.14 Lower Gorge Tributaries Fall Chinook Population

16.2.14.1 Bonneville Hatchery Fall Chinook (URB) Program

16.2.14.1.1 Broodstock History. The broodstock for this upriver bright (URB) fall chinook program originally came from Priest Rapids Hatchery. Broodstock has been collected at the hatchery from 1990 to the present, though URB fall chinook have also been transferred into the program from other hatcheries. There was a tule fall chinook program at the Bonneville Hatchery until 2000, when the program was terminated due to lack of funds and production agreements under U.S. v. Oregon. This tule fall chinook population was considered to be part of the ESU (SSHAG final).

16.2.14.1.2 Similarity between Hatchery-origin and Natural-origin Fish. This program does not release listed fish and is not designed to be integrated with a natural population. Integration of naturally produced URB fall chinook can occur because only a small fraction of the hatchery production is marked.

16.2.14.1.3 Program Design. The purpose of this program is to provide for harvest as mitigation for hydro-system impacts and habitat loss. Production from this hatchery is also released in the Umatilla River basin and Ringgold Springs. The program production goal is 3,500,000 subyearlings released at the hatchery, of which only 100,000 are to be marked with an adipose fin clip and CWT. Additional monitoring is needed to determine the proportion of program fish that are naturally spawning above and below Bonneville Dam.

16.2.14.1.4 Program Performance. Smolt-to-adult survival rates averaged 0.139 percent for the 1994-1998 broodyears. Stray rates have not been determined for program releases, but strays from this program are believed to be contributing to bright fall chinook spawning in the Ives Island area below Bonneville Dam. This population is not considered to be part of the LCR chinook ESU. The program is 55-percent funded through the Mitchell Act and 45-percent funded by the Army Corps of Engineers. Continuation of the portion of the funding provided through the Mitchell Act is uncertain at the present, so that portion of the program is managed on a year-to-year basis.

16.2.14.1.5 VSP Effects. This program has a negative affect on naturally spawning tule fall chinook and chum salmon in the Ives Island area as a result of superimposition of redds and competition for spawning habitat by program fish. More monitoring is needed to evaluate the impact from naturally spawning program fish.

16.2.15 Upper Gorge Tributaries Fall Chinook Population; Big White Salmon River Fall Chinook Population; Hood River Fall Chinook Population

16.2.15.1 Spring Creek NFH Tule Fall Chinook Program

16.2.15.1.1 Broodstock History. Fall chinook from the Big White Salmon River were used to establish the Spring Creek NFH fall chinook program. The program uses only returns to the hatchery for broodstock, but it has incorporated other tule stocks. The last time non-Spring Creek NFH tule fall chinook were released from the hatchery was in 1991 (Bonneville tule fall chinook).

16.2.15.1.2 Similarity between Hatchery-origin and Natural-origin Fish. Condit Dam on the Big White Salmon (1913) blocked access to a majority of the fall chinook habitat in the basin. Additional fall chinook habitat was lost in the Big Salmon River and other tributaries in the upper gorge area when Bonneville Dam was completed, inundating the lower reaches of the tributaries to the Columbia River. The Spring Creek NFH tule fall chinook is the most representative of the native chinook population that was historically present in the Big White Salmon River.

16.2.15.1.3 Program Design. The purpose of the program is to mitigate for lost and degraded habitat due to the construction and operation of the Columbia River hydro-system by producing locally adapted broodstock for sport, commercial, tribal, and international harvest. This is an isolated program that uses returning hatchery-origin adults for broodstock. The production goal for the current program is for a total release of 15,100,000 subyearlings annually. This production requires a minimum of 7,000 adults (4,000 females). This large broodstock will maintain the diversity of the population, and the program practices BMPs. When Condit Dam is removed, fall chinook from the program will be used to re-introduce fall chinook into the basin. Genetic analysis of naturally spawning fall chinook in the Big White Salmon and other Bonneville Pool tributaries is being conducted to determine if Spring Creek NFH fall chinook are representative of the naturally spawning populations of fall chinook.

16.2.15.1.4 Program Performance. The stray rate into local tributaries of Spring Creek NFH tule fall chinook is unknown, but program fish are supporting naturally spawning tule fall chinook in upper gorge tributaries. It is unknown the exact proportion of program fish on the spawning grounds, because only a small portion of the program fish are marked. Habitat is very limited within the reference populations, and with the large returns of program fall chinook, a majority of the spawners are probably program fish. These program fish also contribute to natural spawning populations in the Big White Salmon River and the Hood River. The number of tule fall chinook spawners has increased in recent years with 1,499 being observed in the Wind River, 11,480 in the Big White River, and 9,838 in the Klickitat River (preliminary estimates for 2003, WDFW 4/9/04 email). Smolt-to-adult survival rates averaged 0.136 percent for the 1991-95 broodyears (Spring Creek NFH HGMP 2002). The total exploitation rate for the hatchery program was as high as 75.3 percent for the 1982-89 broodyears. A more recent estimate has the total exploitation rate at 67 percent, with nearly half of the impacts occurring in-river, primarily in the Zone 6 area above Bonneville Dam (Spring Creek NFH HMGP 2002). The Spring Creek NFH is funded through the Mitchell Act and by the Army Corps of Engineers. Future funding of

this program is uncertain. The program is currently under-funded, and it has a large backlog of maintenance and monitoring needs.

16.2.15.1.5 VSP Effects. This program provides a net benefit by supporting naturally spawning populations above Bonneville Dam. It increases the spatial distribution and will act as a source for adults and broodstock for reintroduction into the Big White Salmon River once Condit Dam is removed.

16.2.15.2 Carson NFH Spring Chinook Program

16.2.15.2.1 Broodstock History. The spring chinook program did not start until Shipherd Falls was laddered in 1955. At that time the hatchery was remodeled to produce a number of species, but currently, only spring chinook are reared at the facility. From 1955 to 1964, approximately 500 spring chinook were trapped annually at Bonneville Dam and transported to the Carson Hatchery. Since that time, broodstock has been collected from adults returning to the hatchery.

16.2.15.2.2 Similarity between Hatchery-origin and Natural-origin Fish. The Wind River basin did not support a naturally spawning population of spring chinook. Hatchery and natural fish have not been successful at producing offspring in the wild. The Carson NFH spring chinook program is an isolated program.

16.2.15.2.3 Program Design. The purpose of the program is to rear 1,420,000 spring chinook salmon smolts for release at the hatchery as mitigation for lost and degraded habitat due to the construction and operation of the Columbia River hydro-system. This is to be done by producing locally adapted broodstock for sport, commercial, and tribal harvest. The hatchery release is 100-percent marked with adipose fin clips to allow for selective fisheries.

16.2.15.2.4 Program Performance. Annual returns to the Carson Hatchery have averaged 3,797 adults since 1980 and exceeded 10,000 in 2000, 2001, and 2002. Smolt-to-adult survival averaged 0.25 percent for the 1991-95 broodyears (Carson NFH HGMP 2002). Recent smolt-to-adult survivals have exceeded those levels, e.g., the smolt-to-adult survival rate for the 1996 brood was almost 1 percent. Surplus adults have been provided to tribes and local food banks. The recent returns have also supported strong recreational and tribal fisheries in the Wind River. This program is 100-percent funded through the Mitchell Act, and future funding is uncertain. The program is currently under-funded, and it has a backlog of maintenance and monitoring needs.

16.2.15.2.5 VSP Effects. This program has a neutral effect on the Lower Columbia River chinook salmon ESU. Program fish have limited interactions with listed chinook populations that are rearing in the lower Wind River. Juvenile hatchery fish are released prior to emergence of listed fish, monitoring indicates that program fish leave the basin quickly (Carson NFH HGMP 2002).

16.2.15.3 Little White Salmon NFH Fall Chinook (URB) Program

16.2.15.3.1 Broodstock History. The original source of this stock of upriver bright fall chinook was collected at the Bonneville State Fish Hatchery (see program above). The current source of URB fall chinook is returns to the Little White Salmon NFH.

16.2.15.3.2 Similarity between Hatchery-origin and Natural-origin Fish. The URB fall chinook stock is not native to the Little White Salmon and is not considered part of the LCR chinook ESU. There is a small number of tule fall chinook that spawn in the limited habitat below the weir at the hatchery facility. This habitat becomes inundated when Bonneville Dam is at full pool. These tule fall chinook are probably strays from the Spring Creek NFH.

16.2.15.3.3 Program Design. The purpose of the program is to successfully rear and release upriver bright fall chinook salmon into the Little White Salmon River to provide mitigation for lost and degraded habitat due to the construction and operation of the Columbia River hydro-system, to meet U.S. v. Oregon court agreements, and to provide 1.7 million fry for release in the Yakima River basin. The program production goal, in addition to the 1.7 million fry release into the Yakima River basin, is to release 2.0 million subyearlings at the hatchery. This hatchery program is managed as an isolated program.

16.2.15.3.4 Program Performance. The program has been successful in meeting the broodstock need for 1,860 adults, except in 1998 when URB stock from other programs was used to fill production shortfalls due to equipment failure. Stray rates to other tributaries in the upper gorge area have not been determined, but naturally spawning URB fish have been observed in Bonneville Pool tributaries and below Bonneville Dam. These strays adversely impact tule fall chinook populations as a result of redd imposition and competition for resources, though additional monitoring is needed to evaluate the extent of these impacts. Harvest rate estimates for the 1990, 1991, and 1992 broodyears were 46.7 percent, 52.2 percent, and 37.3 percent, respectively (LWS NFH URB HGMP 2002). The 1990-94 average broodyear juvenile-to-adult survival was 0.32 percent. The on-station release portion of this program is 100-percent funded through the Mitchell Act, and future funding of this program is uncertain. The Yakima basin releases are partially funded by BPA.

16.2.15.3.5 VSP Effects. This program has a negative affect on naturally spawning tule fall chinook and chum salmon in the Ives Island area and in the upper gorge tributaries. More monitoring is needed to determine the level and extent of these impacts from naturally spawning program fish.

16.2.15.4 Little White Salmon NFH Spring Chinook Program

16.2.15.4.1 Broodstock History. Many stocks from throughout the Columbia River basin were used to develop the spring chinook program at the hatchery, though the present stock is considered a derivative of the Carson spring chinook stock. The current program is supported by adults returning to the hatchery. The last time non-Little White Salmon fish were released at the hatchery was in 1985.

16.2.15.4.2 Similarity between Hatchery-origin and Natural-origin Fish. There are no naturally spawning spring chinook populations in the Little White Salmon River. This hatchery program is managed as an isolated program.

16.2.15.4.3 Program Design. This is an isolated harvest program with the specific purpose of releasing 1.0 million yearling spring chinook smolts on-station for harvest to help mitigate for fish losses in the Columbia River basin caused by mainstem hydro-system construction and other development. The program also produces spring chinook for release into the Umatilla River basin as part of a reintroduction program for spring chinook. The Umatilla River program receives 350,000 yearling smolts for release at acclimation facilities within the basin. All fish released through the program are adipose fin-clipped to allow for selective fisheries and differentiation from natural fish.

16.2.15.4.4 Program Performance. The stray rate for this program has not been determined but is expected to be low. The smolt-to-adult survival rate averaged was 0.24 percent for the 1991-95 broodyears and ranged from .03 percent to 0.55 percent (LWS NFH Spring Chinook HGMP 2003). The harvest rate has ranged from 0.0 to 46.6 percent, depending on the broodyear. The development of selective fisheries is expected to increase the harvest rate on this stock of spring chinook. Returns to the hatchery also support tribal fisheries in Zone 6 above Bonneville Dam and recreational fisheries in Drano Lake. This program is 100-percent funded through the Mitchell Act, and future funding of this program is uncertain. The program is currently under-funded, and it has a backlog of maintenance and monitoring needs. The Umatilla portion of the program is funded by BPA.

16.2.15.4.5 VSP Effects. This program has a neutral effect on the Lower Columbia River chinook salmon ESU. These fish have limited interactions with listed chinook populations that are rearing in the local tributaries.

16.2.16 Hood River Spring Chinook Population

16.2.16.1 Hood Spring Chinook Program

16.2.16.1.1 Broodstock History. The historical Hood River spring chinook population was extirpated and probably was never large due to limited habitat in the Hood River basin and silt loads from Mt. Hood glaciers. Because the local population was extirpated, the closest population with returns great enough to support the program was transplanted from the spring chinook program at Round Butte Hatchery on the Deschutes River. Currently, the program uses both adults returning to Hood River and spring chinook from Round Butte Hatchery. If sufficient naturally produced adults return, the program will develop a local broodstock for the program. At present, Deschutes River spring chinook are still needed to support the program.

16.2.16.1.2 Similarity between Hatchery-origin and Natural-origin Fish. The program is attempting to develop a local broodstock that will be representative of the naturally producing spring chinook in the basin.

16.2.16.1.3 Program Design. The program goal is to support the reintroduction of spring chinook into the Hood River basin. Deschutes River spring chinook have been reared at Round Butte Hatchery and acclimated in the Hood River basin. Problems with the short period of acclimation have hindered homing of adult fish back to the basin, leading to a large number of program fish straying back to the Deschutes River. Production of spring chinook for the program in Pelton Ladder (part of Round Butte Hatchery) has caused a very high level of precocialism in the spring chinook program, further reducing the potential for success. Monitoring has identified that a large number of naturally produced juveniles emigrate from the basin as parr, which is different from the smolt life stage that is used to supplement the natural population. The final factor is that habitat within the basin is limited for spring chinook and may not be able to support a population that will provide for meaningful harvest opportunities for tribal and recreational fishers. One proposal to address some of these concerns is to build a full-term rearing facility in the basin. This is being considered as part of the evaluation of the Hood River Production Program.

16.2.16.1.4 Program Performance. The program produces a large number of strays back to the Deschutes River basin, due to the lack of adequate time to acclimate the spring chinook and the rearing regime in the Pelton Ladder. The reintroduction program has been successful in producing naturally spawning adults and hatchery returns, but monitoring and evaluation activities have determined that the capacity of the Hood River basin for spring chinook production is very limited and may have supported a very small population of spring chinook that may have not been viable (Hood River Program Review 2003).

16.2.16.1.5 VSP Effects. This program at present does not provide a benefit to the ESU.

16.3 CONCLUSIONS

Existing Status: Threatened
BRT Finding: Threatened
Recommendation: Threatened

16.3.1 ESU Overview

16.3.1.1 History of Populations

The WLC TRT tentatively identified 31 populations (20 fall (tule) run, 2 late fall run (brights) and 9 spring run) within the LCR chinook salmon ESU (Myers et al. 2002). Three spring chinook salmon populations in the Cowlitz River basin (Upper Cowlitz River, Cispus River and Tilton River) were extirpated due to the construction of Mayfield Dam, the Upper Cowlitz River fall chinook population was also extirpated due to dam construction. A re-introduction program for the spring chinook populations in the Upper Cowlitz and Cispus rivers was initiated in 1996. The construction of Condit Dam on the Big White Salmon River extirpated the spring chinook population in this basin. The spring chinook population in the Hood River was also considered extirpated, and a re-introduction program using non-ESU spring chinook from the Deschutes River was implemented in 1998.

The tule fall chinook populations in the ESU are: Youngs Bay, Grays River, Big Creek, Elochoman River, Clatskanie River, Mill-Abernathy-Germany, Lower Cowlitz River, Coweeman River, Toutle River, Kalama River, Lewis River/ Salmon Creek, Washougal River, Clackamas River, Sandy River, Lower Gorge Tributaries, Upper Gorge Tributaries, Hood River, and Big White Salmon River. The late fall chinook populations are: Sandy River Late fall and Lewis River Late fall. The remaining spring chinook populations are: Toutle River, Kalama River, Lewis River, and Sandy River.

16.3.1.2 Association Between Natural Populations and Artificial Propagation

Natural populations "with minimal genetic contribution from hatchery fish"
Artificial propagation programs for steelhead were historically, and are currently, in almost all of the basins within the LCR chinook salmon ESU. There are presently four of the 20 extant populations in this ESU that are likely to be subject to minimal or less genetic influence from hatchery-origin fish. These populations are the Coweeman River fall chinook, Lewis River/Salmon Creek fall chinook, Lewis River late fall chinook and Sandy River late fall chinook. Data is missing for a number of populations that may meet the criteria: Clatskanie fall chinook, Scappoose fall chinook, Clackamas River fall chinook and Sandy River fall chinook.

Natural[b] populations "that are stable or increasing, are spawning in the wild, and have adequate spawning and rearing habitat" [c]
There are only two populations that meet the criteria: Coweeman River fall chinook and Lewis River late fall chinook.

Mixed (Integrated Programs[d])
Mixed (aggregate natural and hatchery-origin) fall chinook populations in the ESU are: Grays River, Big Creek, Elochoman River, Lower Cowlitz River, Toutle River, Kalama River, Washougal River, Upper Gorge Tributaries, and Big White Salmon River. The mixed spring chinook populations are: Upper Cowlitz River, Cispus River, Kalama River, Lewis River, and Sandy River.

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[b] See HLP for definition of natural, mixed and hatchery populations

[c] HLP Point 3

[d] Integrated programs follow practices designed to promote and protect genetic diversity and only use fish from the same local population for broodstock (both natural-origin fish, whenever possible, and hatchery-origin fish derived from the same local population and included in the ESU). Programs operated to protect genetic diversity in the absence of natural-origin fish (e.g., captive broodstock programs and the reintroduction of fish into vacant habitat) are considered "integrated".

Hatchery (Isolated[e])
There are number of programs that release hatchery fish that are part of the ESU but are not part of the population where the fish are released: Astoria High School STEP Fall Chinook Program, Warrenton High School STEP Fall Chinook Program, and Deep River Net Pens Spring Chinook Program. The following hatchery programs release chinook salmon that are not part of the ESU: CEDC Select Area Brights Program, CEDC Spring Chinook Program, Bonneville Hatchery Fall Chinook (URB) program, Carson NFH Spring Chinook, Little White Salmon NFH Fall Chinook (URB) Program, Little White Salmon NFH Spring Chinook Program, and the Hood River Spring Chinook Program.

16.3.2. Summary of ESU Viability:

16.3.2.1 Abundance. Estimated natural-origin returns and the total number of natural spawners (i.e., the combination of natural-origin and hatchery-origin chinook included in the ESU) have increased since 1998 when the ESU was listed as threatened. However, average total (aggregate natural and hatchery-origin chinook salmon) escapements to natural spawning areas for the most recent years, though increasing, remain well below historical levels as estimated by EDT analysis. The high proportion of hatchery-origin chinook spawning naturally indicates that some populations are being sustained by hatchery fish. Abundance information is not available for many populations.

16.3.2.2 Productivity. There are no data indicating hatchery programs have increased ESU productivity. In the BRT (2003) analysis, when it was assumed that hatchery-origin adults contributed to the natural spawning population, productivity estimates for those populations declined.

16.3.3.3 Spatial Structure. The risk to the spatial structure of the ESU has been reduced by the re-introduction program in the Cowlitz River basin (Upper Cowlitz River, Cispus River, Tilton River populations). The other integrated programs have supported the maintenance of the ESUs spatial structure.

16.3.3.4 Diversity. The integrated propagation programs appear to be preserving chinook stock structure, however those programs that have incorporated fish from other populations to meet production goals have reduced diversity. The continued release of non-ESU chinook into areas where natural populations are present remains a risk factor to the preservation of genetic diversity remaining among chinook salmon populations within the ESU.

16.3.3. Artificial Propagation Record

16.3.3.1 Experience with Integrated Programs. Many of the integrated programs within the ESU have been in operation for decades with the Kalama River hatchery a century. However,

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[e] Isolated programs do not follow practices designed to promote or protect genetic diversity. Fish that are reproductively isolated are more likely to diverge genetically from natural populations included in the ESU and to be excluded themselves from the ESU.

most of the integrated programs did not follow practices designed to promote and protect genetic diversity by only using fish from the same local population for broodstock. Fish from other basin and even other ESUs were routinely incorporated into many programs. Fall chinook programs have not actively integrated natural-origin fall chinook because only a small portion of the hatchery-origin adults have been externally marked. Programs probably incorporated natural-origin adults into the broodstock because they could not be distinguished from hatchery fall chinook.

16.3.3.2 Are Integrated Programs Self-Sustaining. Program management now requires that all of the integrated programs be self-sustaining, restricting the practice of using production from other programs to back fill shortfalls. This has not been a concern with abundant returns observed in recent years.

16.3.3.3 Certainty that Integrated Programs will Continue to Operate. The Cowlitz River basin programs are funded by Tacoma Power Utilities as mitigation for impacts from the construction and operation of the hydro-system on the Cowlitz River. Funding of these programs is required under the FERC license, but programs will change if natural production is established above the dams. The programs in the Lewis River basin are funded by Pacificorps as mitigation for impacts from the construction and operation of dams on the North Fork Lewis River. Funding of these programs is required under the FERC license, but programs will likely change during the current relicensing process.

The Hood River propagation program is funded by the BPA through the Fish and Wildlife Program. This program will go through periodic review to continue to get funding and could lose funding if priorities change or BPA reduces funding to the Fish and Wildlife Program. The Mitchell Act funds a number of programs: Big Creek Fall Chinook, Elochoman River Fall Chinook Program, North Toutle Fall Chinook, Kalama River Fall Chinook Program, Kalama River Spring Chinook, Washougal River Fall Chinook, Sandy River Spring Chinook, and Spring Creek NFH Fall Chinook. Mitchell Act funding has continued to decline over time and future funding of these programs is uncertain.

16.3.4. Summary of Overall Extinction Risk Faced by the ESU:

The overall abundance of the ESU has increased since the previous status review, but the increase in natural spawning adults (both hatchery and natural-origin) is still will below historical abundances. Artificial propagation programs have supported the increases in abundance in the Cowlitz River, Elochoman River, Big Creek, Kalama River, and Washougal River basins. The Cowlitz River basin re-introduction programs are attempting to increase the spatial distribution of the LCR chinook salmon, but self sustaining populations have not been established. The integrated programs are operating to preserving genetic diversity remaining in the ESU. The continued release of hatchery fish that are not part of the local population remains a risk factor to the preservation of genetic diversity remaining among chinook populations within the ESU.

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